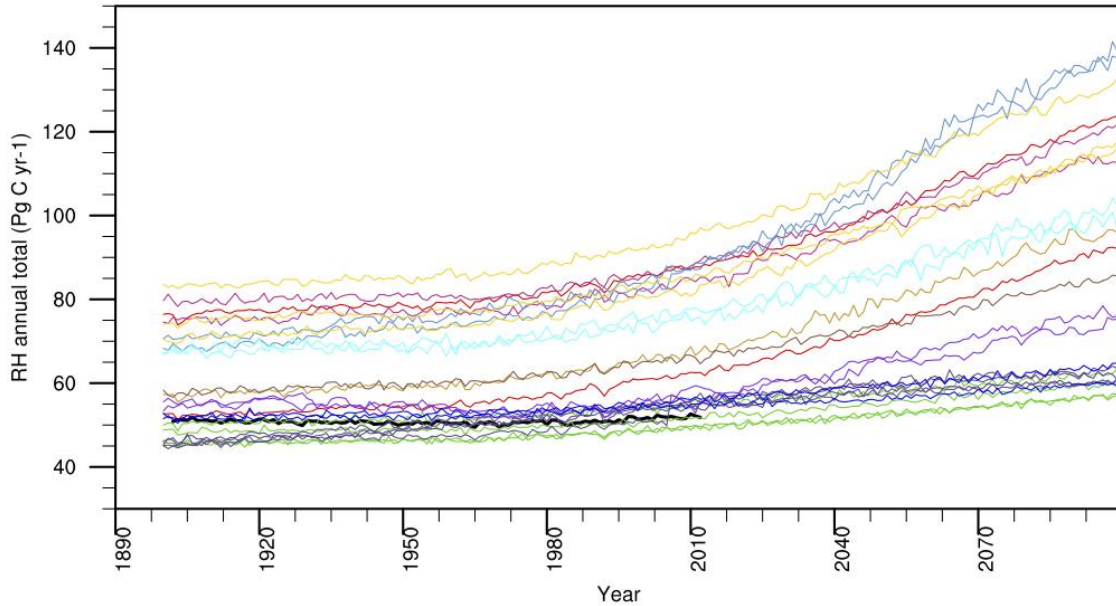


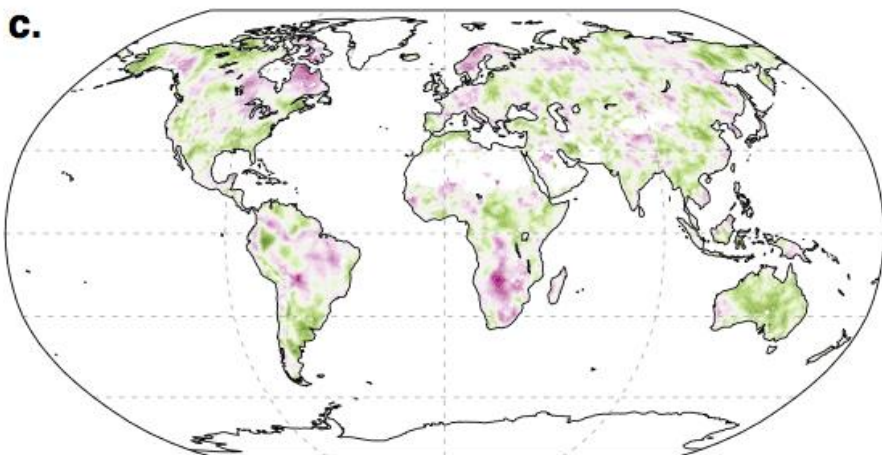
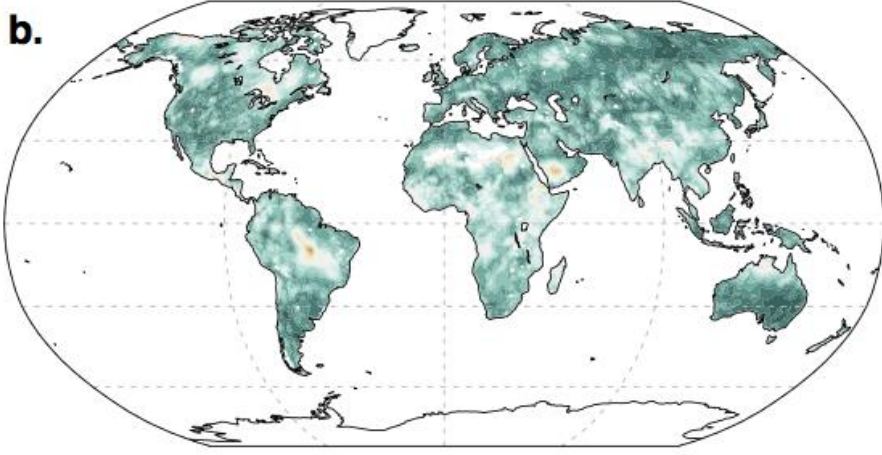
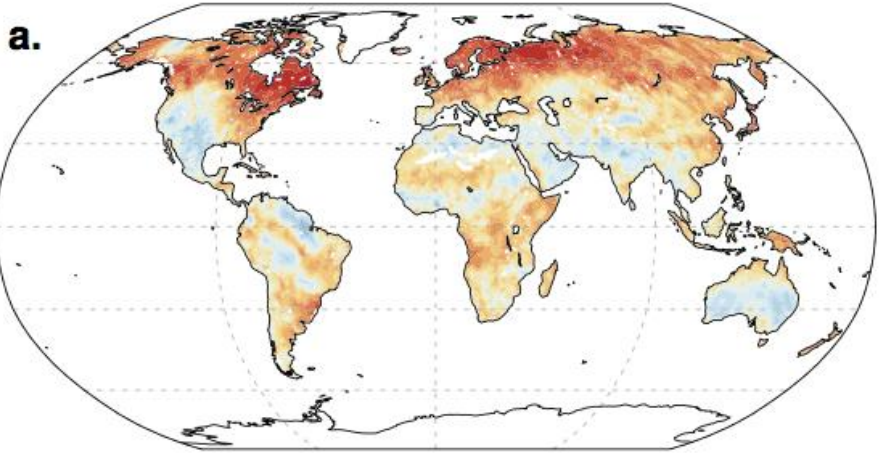
Causes of uncertainty in observed and projected heterotrophic respiration from Earth System Models

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Supplementary material



Supplementary Figure 1: Annual total heterotrophic respiration (RH), for 25 CMIP5 models, combining the RCP 8.5 and historical outputs. Black line is the 'observed' global annual RH. Color of lines correspond to models from same modeling center.

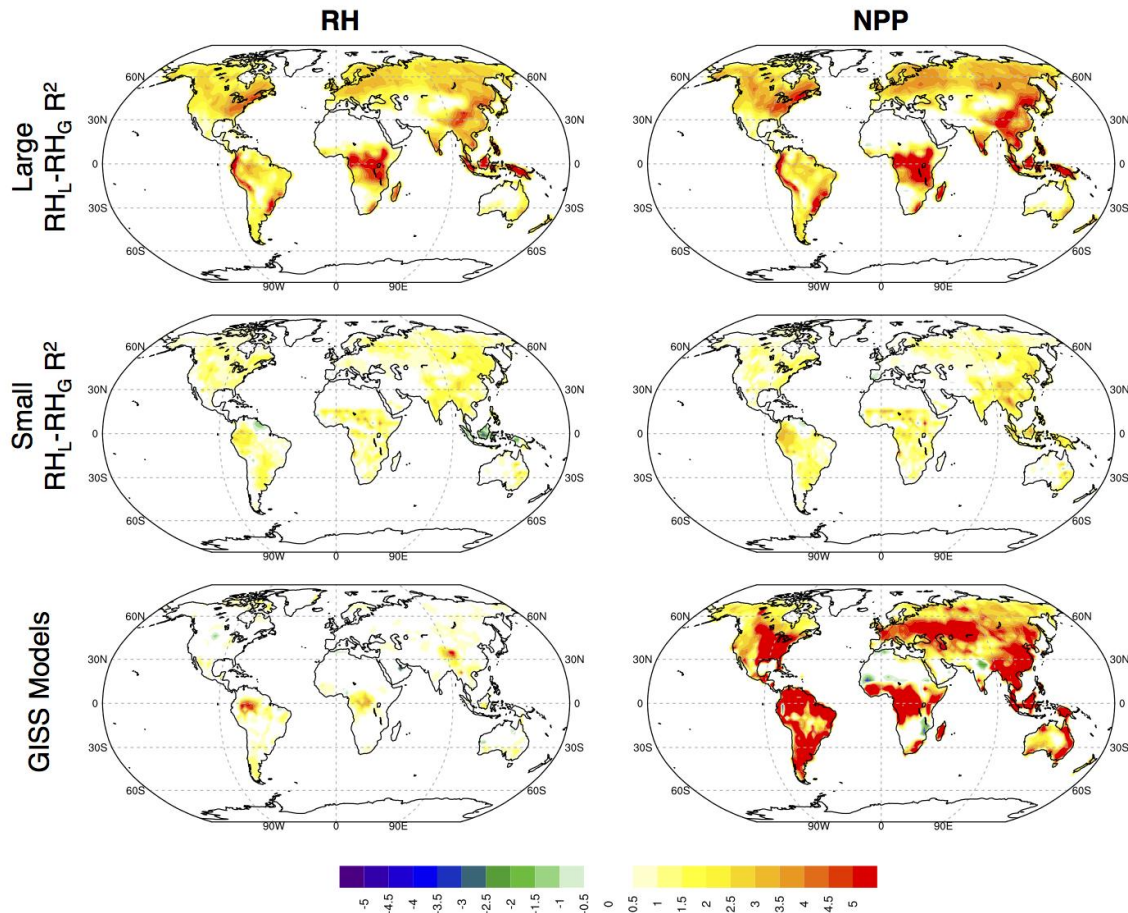


Supplementary Figure 2: Pearson correlation between observed annual heterotrophic respiration and surface temperature (a, 1948-2010), precipitation flux (b, 1979-2010), and net primary production (c, 2000-2013).

	TAS (°C)	PR (mm)	RH (Pg C)	NPP (Pg C)
bcc-csm1-1	3.711	66.544	39.809	40.982
bcc-csm1-1-m	3.504	67.942	33.408	32.705
BNU-ESM	4.838	75.932	33.036	32.487
CanESM2	4.853	69.223	21.387	23.163
CCSM4	3.915	65.818	8.020	13.075
CESM1-BGC	3.810	65.655	8.484	12.936
CESM1-CAM5	4.556	78.462	8.760	14.295
CESM1-WACCM	3.605	55.522	7.885	14.358
GFDL-ESM2G	3.327	36.039	35.476	55.123
GFDL-ESM2M	3.100	30.127	32.879	52.032
GISS-E2-H	3.162	50.949	7.069	72.514
GISS-E2-H-CC	3.162	48.016	7.659	72.092
GISS-E2-R	2.703	40.970	6.682	70.910
GISS-E2-R-CC	2.732	40.462	6.620	70.029
HadGEM2-CC	5.344	76.611	56.642	58.125
HadGEM2-ES	5.109	70.413	54.991	57.069
IPSL-CM5A-LR	5.162	107.820	40.505	51.712
IPSL-CM5A-MR	5.079	106.705	33.061	42.216
IPSL-CM5B-LR	3.955	66.188	38.334	52.021
MIROC-ESM	5.359	95.333	20.411	16.096
MIROC-ESM-CHEM	5.583	103.092	21.969	18.906

MPI-ESM-LR	4.020	60.764	26.778	46.876
MPI-ESM-MR	4.047	65.720	27.818	49.502
NorESM1-M	3.678	62.591	5.601	12.637
NorESM1-ME	3.885	63.893	8.443	10.224

Supplementary Table 1: End of 21st century change, calculated from accumulated linear trend from 2006-2099, in surface air temperature (TAS), precipitation flux (PR), heterotrophic respiration (RH) and net primary production (NPP) globally averaged for area between 80°N and 60°S from RCP 8.5 scenario.



Supplementary Figure 3. Model mean annual projected trend in RH (left) and NPP (right) in g/m^2 per year for RCP 8.5 scenario (2006-2099). Models were grouped by average $\text{RH}_L\text{-RH}_G R^2$ into strong (average $R^2 \geq 0.75$, top row) and weak (average $R^2 \leq 0.25$, middle row) $\text{RH}_L\text{-RH}_G$ relationships, and GISS-E2 models (bottom row). Groupings are the same used in Figures 5-9.